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Horne et al.

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(54) **VALVE ASSEMBLIES**

(75) Inventors: **Timothy P. Horne**, Andover, MA (US);
Dale S. Tripp, North Andover, MA (US)

(73) Assignee: **Watts Investment Company**,
Wilmington, DE (US)

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(22) Filed: **Nov. 8, 1999**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 09/189,658, filed on Nov. 10, 1998, now Pat. No. 6,019,349.

(51) **Int. Cl.**⁷ **F16K 5/06**
(52) **U.S. Cl.** **251/148; 285/289.1**
(58) **Field of Search** 251/148, 315.13,
251/315.14; 285/289.1, 289.2, 289.5, 148.13

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Primary Examiner—John Fox

(74) *Attorney, Agent, or Firm*—Fish & Richardson P.C.

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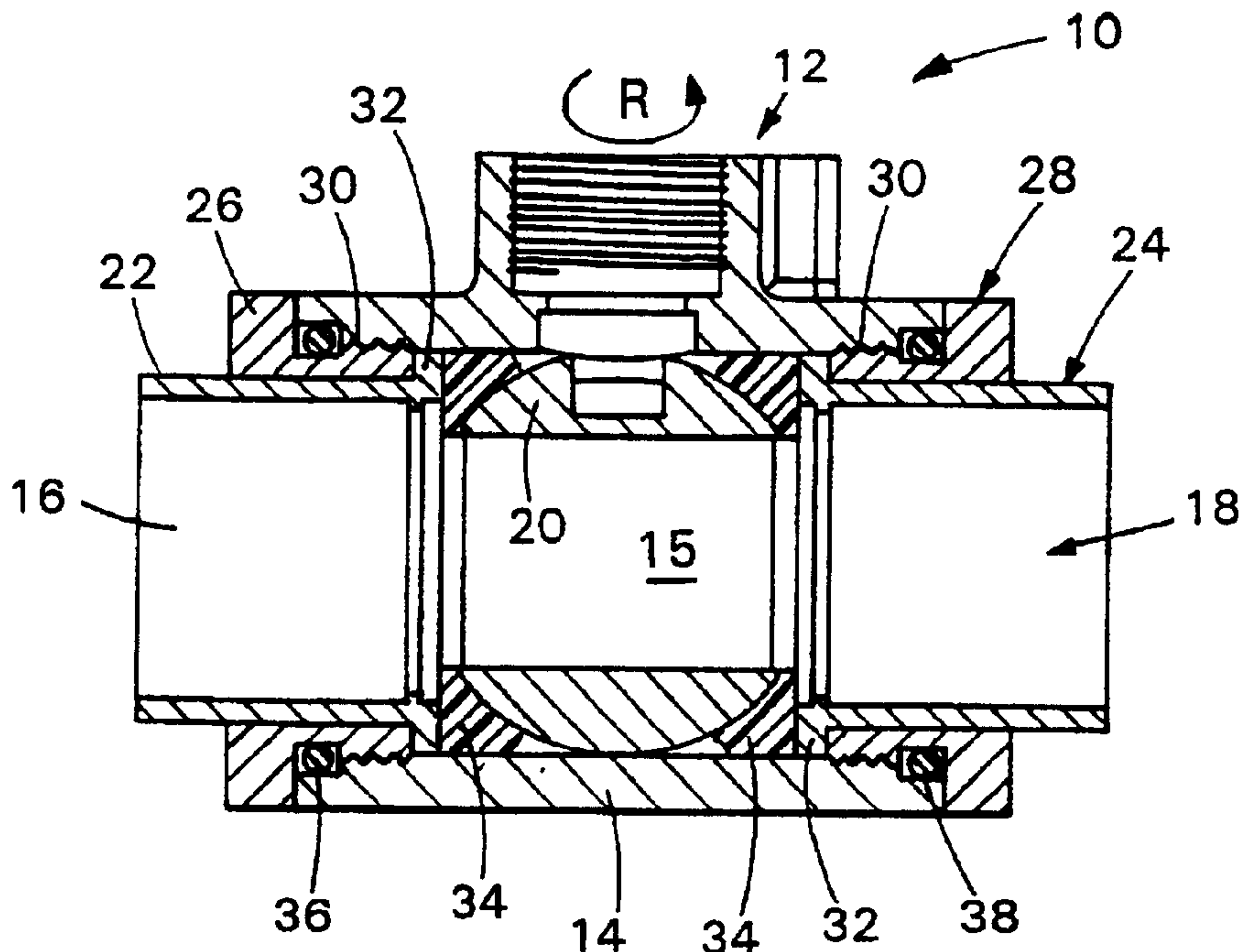
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(57) **ABSTRACT**

A valve assembly includes a valve body defining an inlet and an outlet, and a passageway for flow of fluid from the inlet to the outlet. An attachment member is in removable engagement with the valve body at one of the inlet and the outlet. A pipe coupler is releasably secured to the valve body by the attachment member. The pipe coupler is adapted for attachment to a pipe end by sweating. The pipe coupler defines one, two or three inlets and one outlet. The attachment member is threadedly attached to an internal wall or an external wall of the valve body. The valve assembly is, e.g., a ball valve, a check valve, or a gate valve.

3 Claims, 6 Drawing Sheets



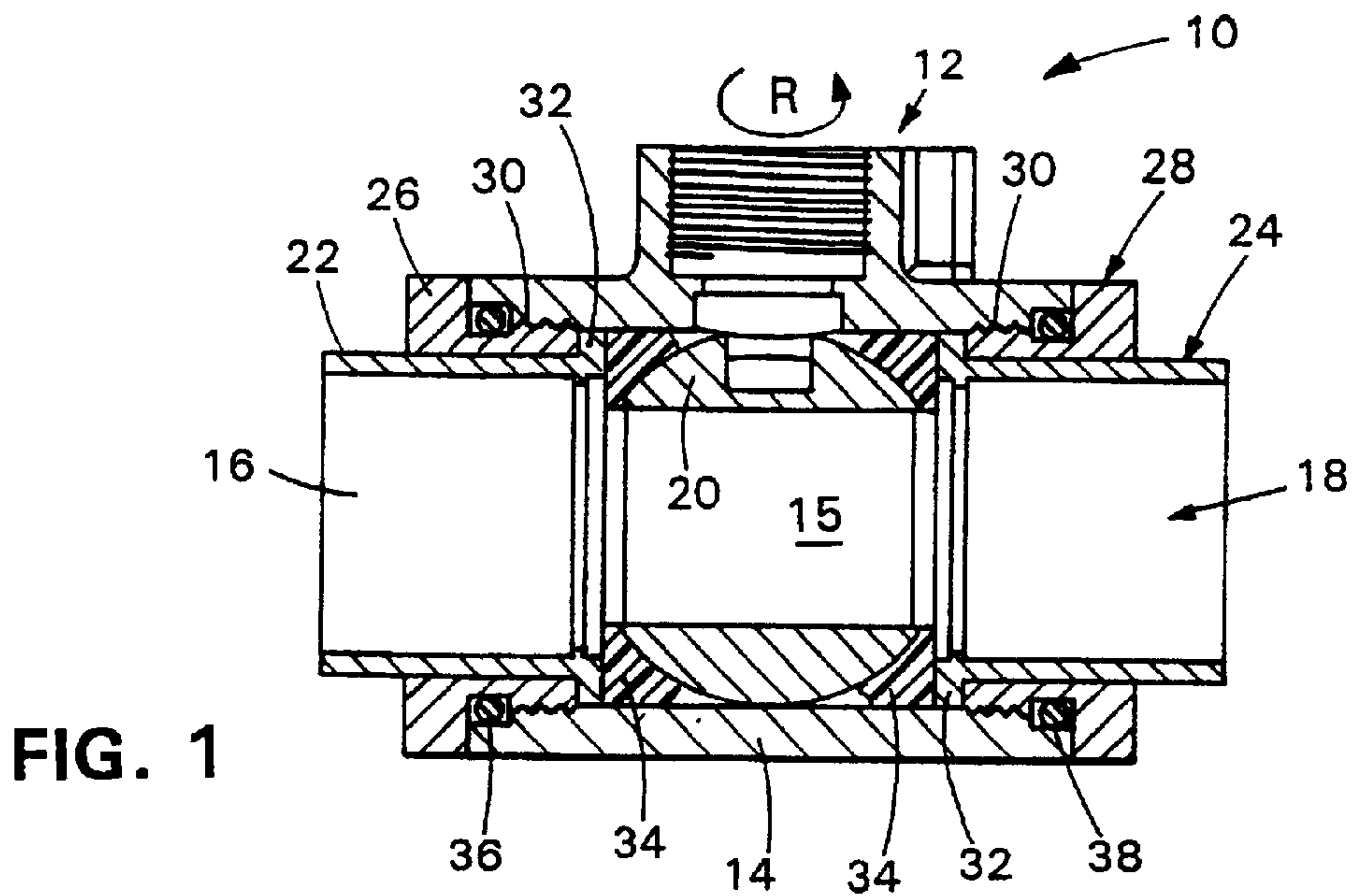


FIG. 1

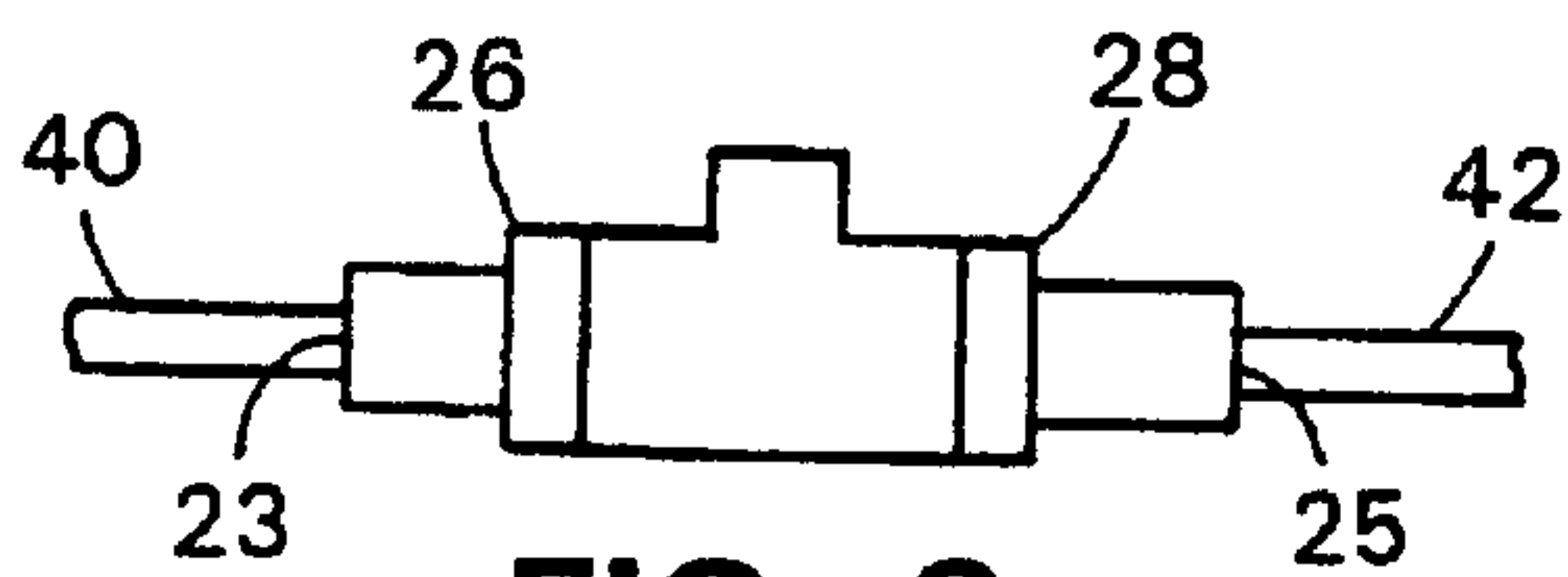


FIG. 2

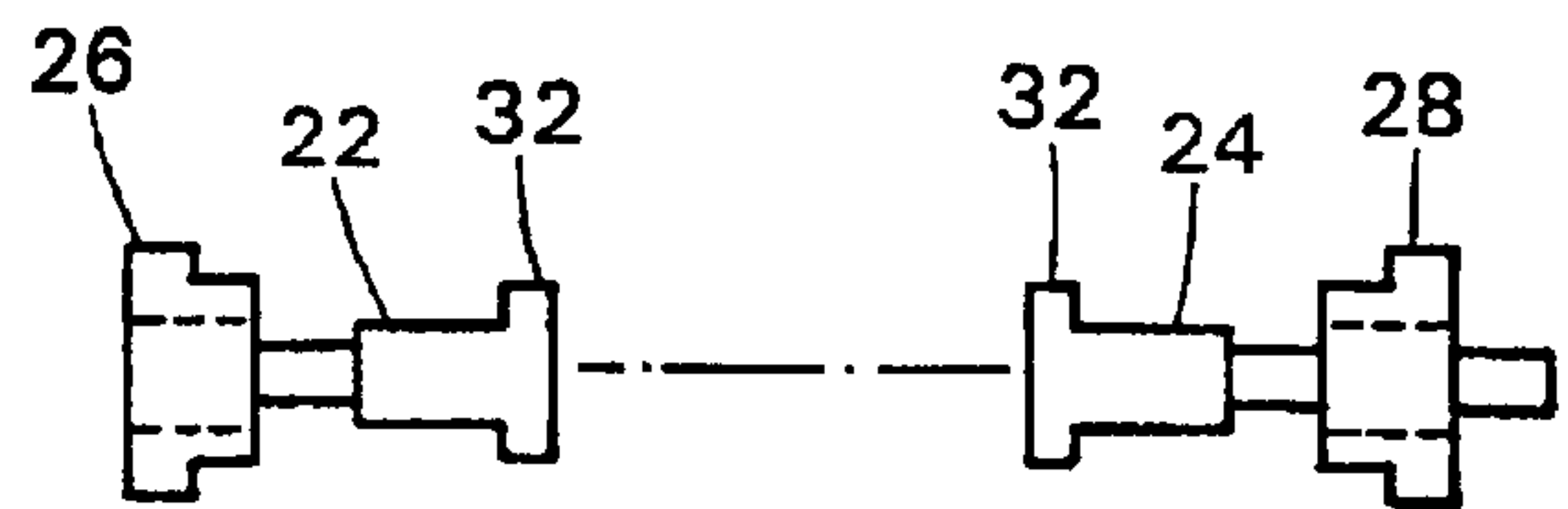


FIG. 3

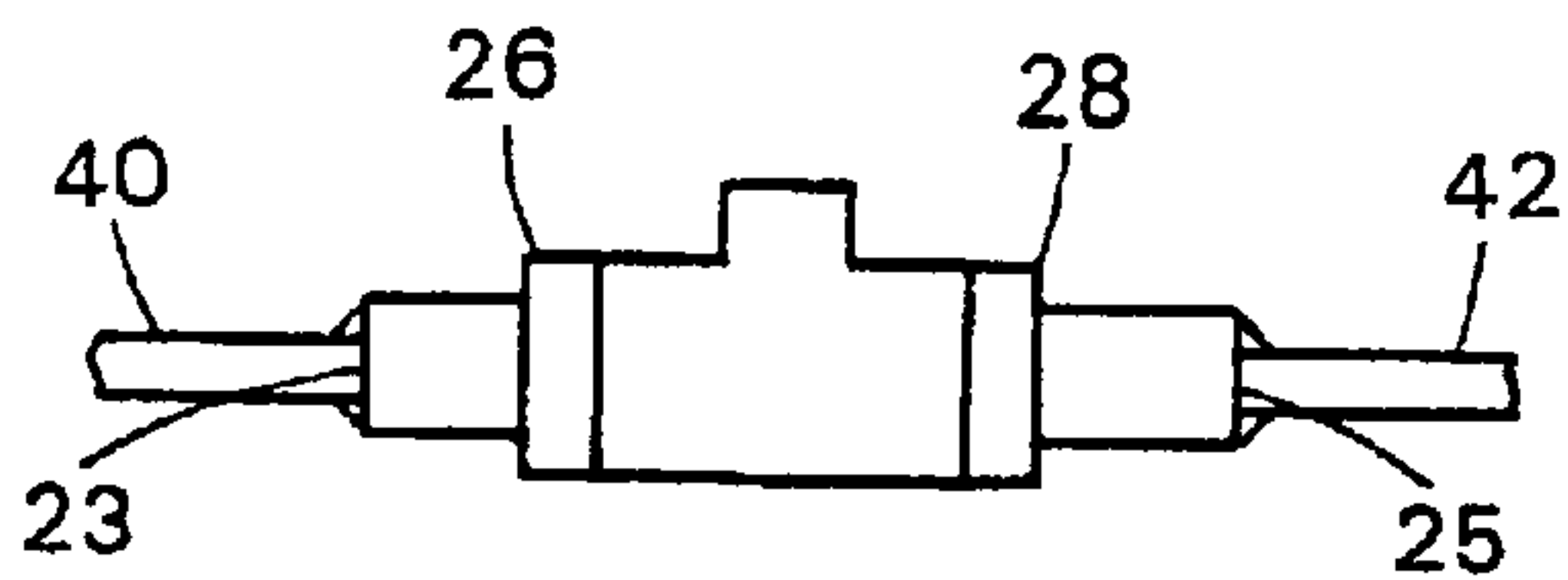


FIG. 4

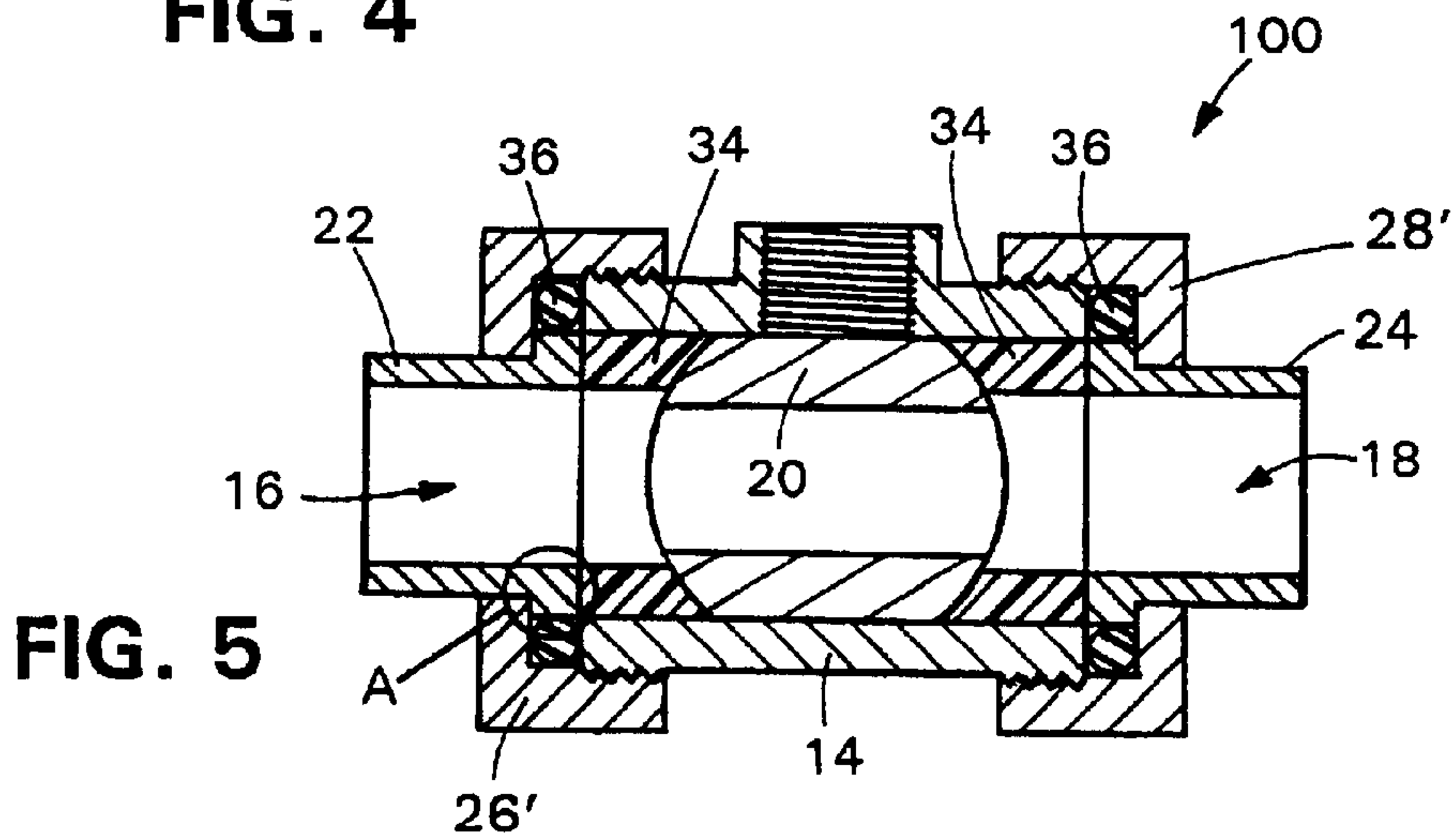


FIG. 5

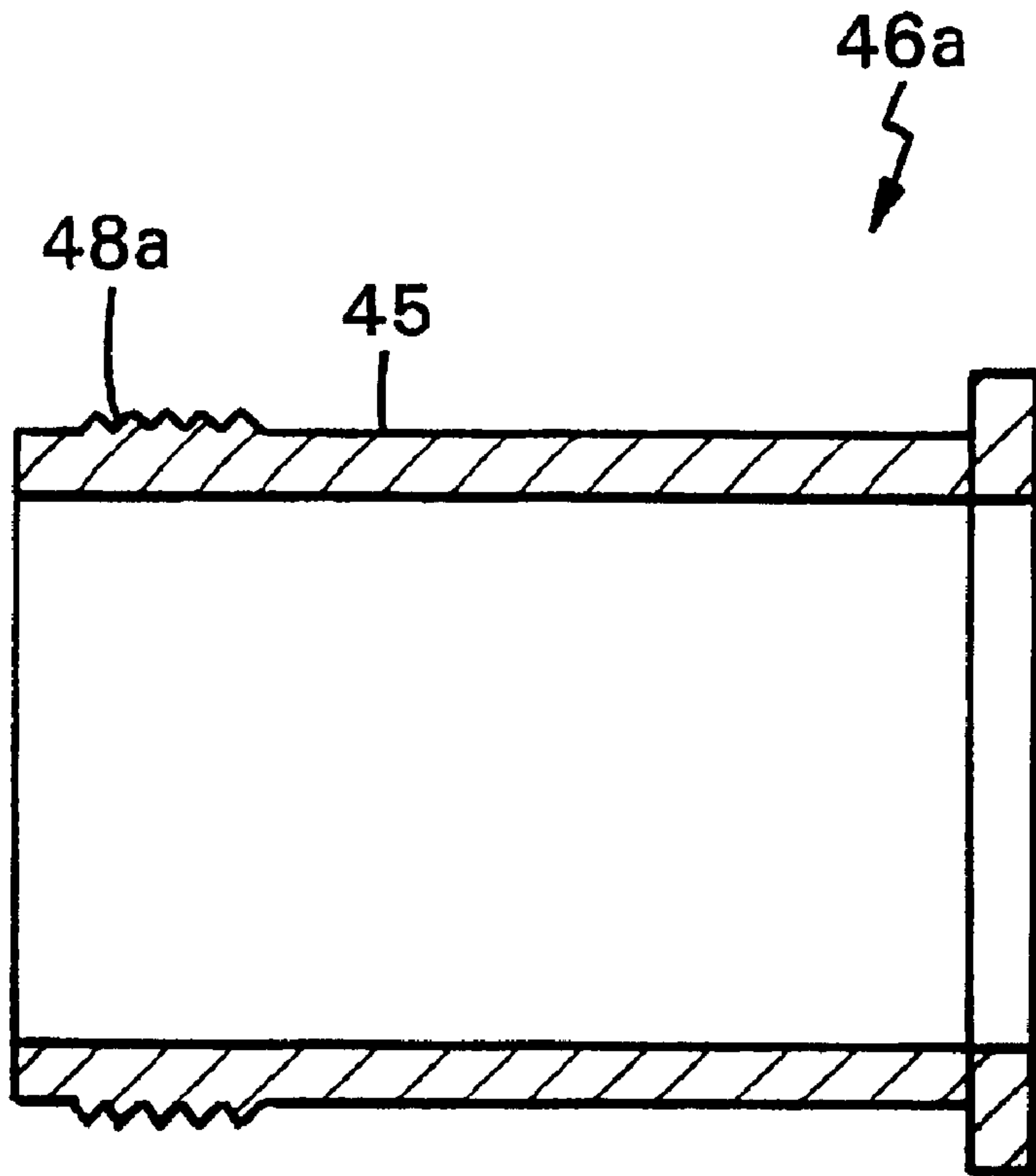


FIG. 6A

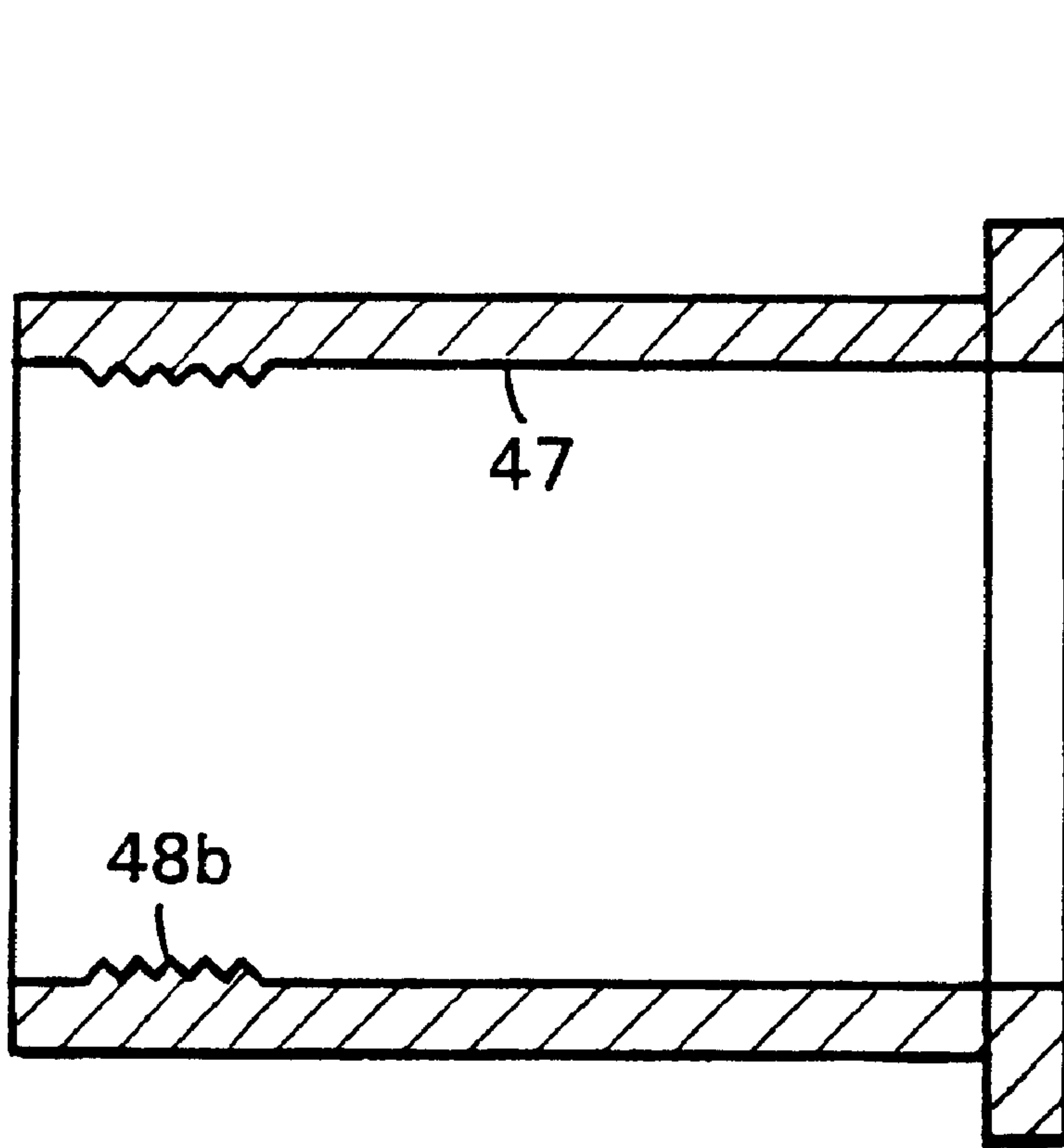


FIG. 6B

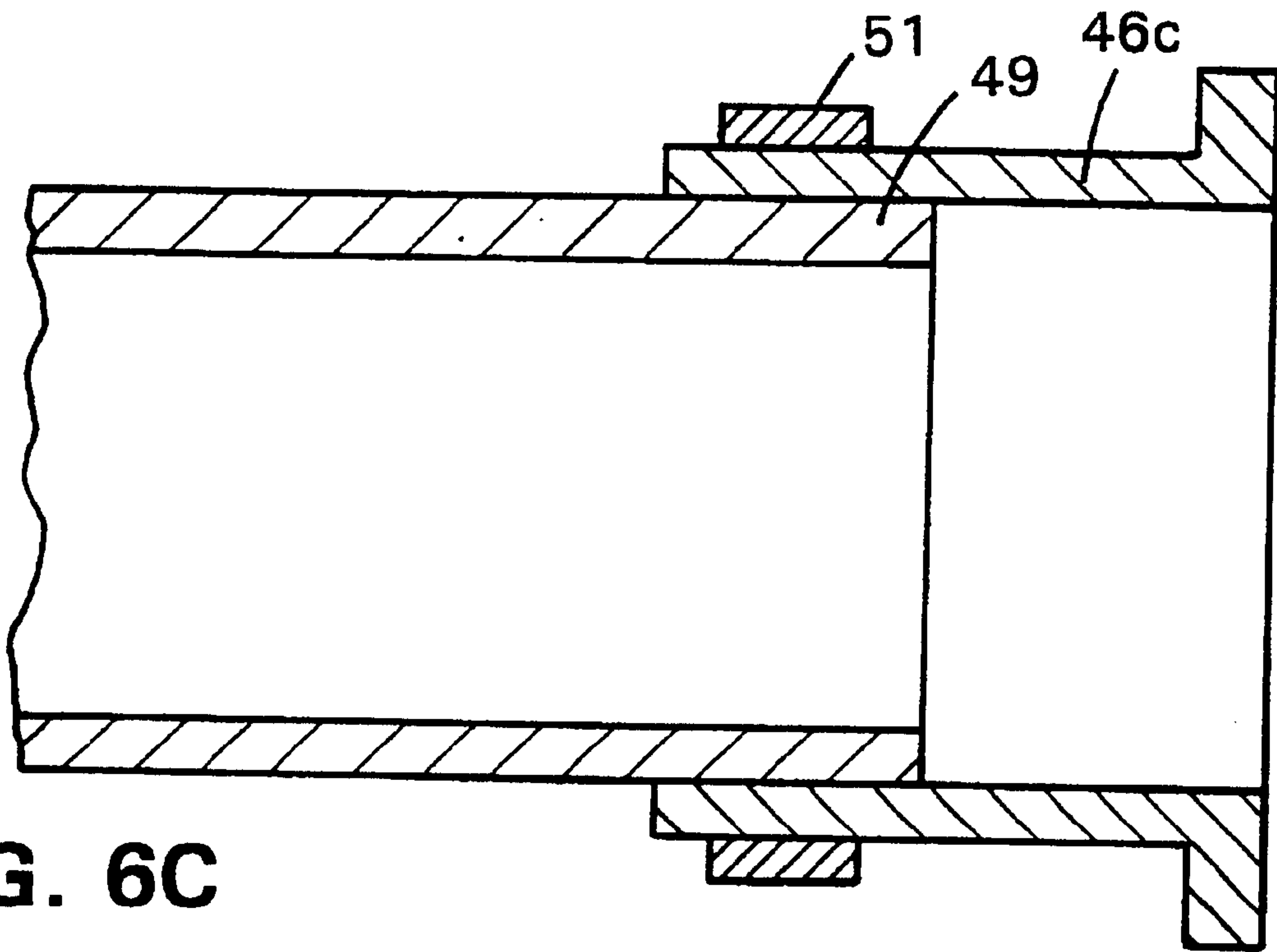


FIG. 6C

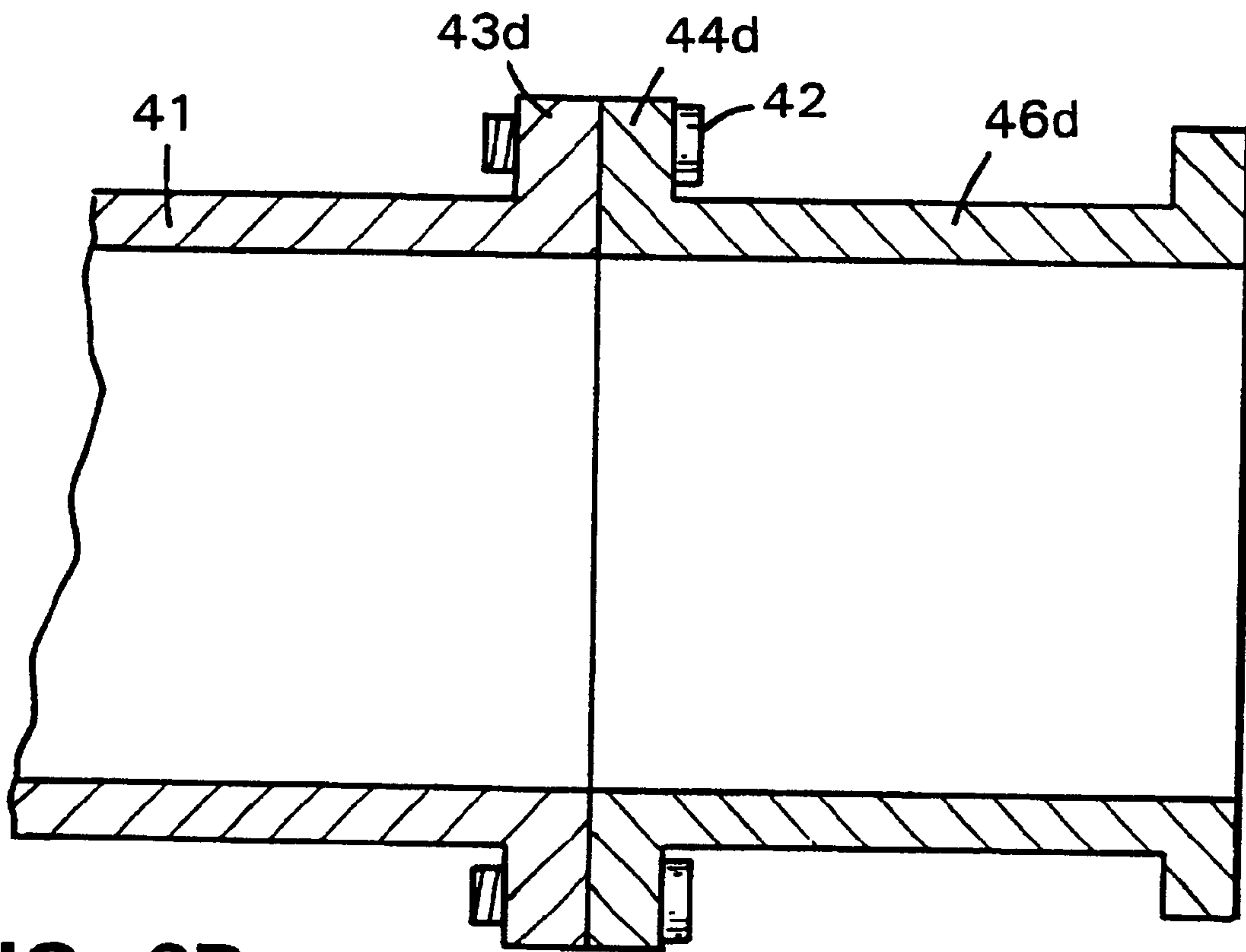


FIG. 6D

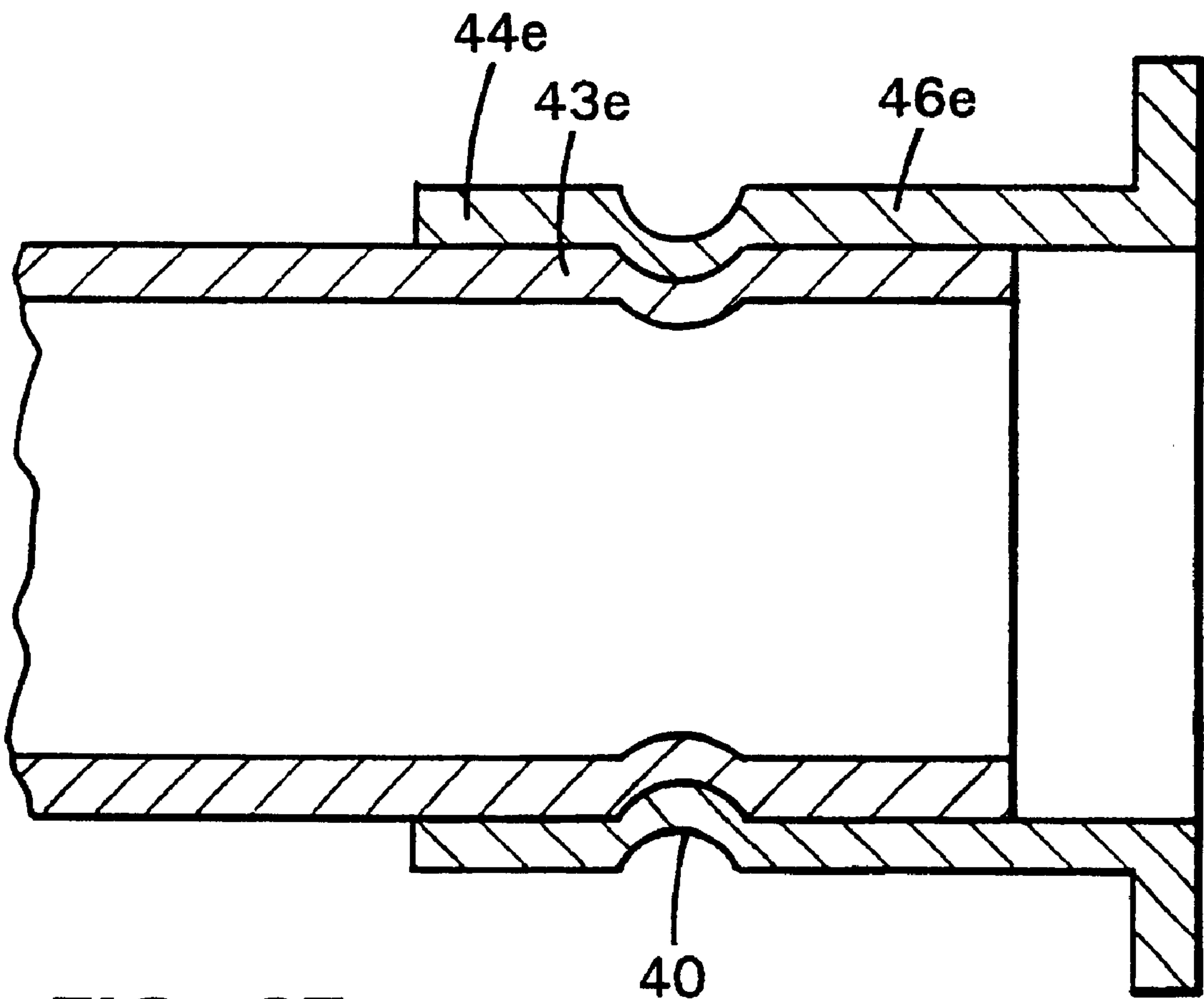


FIG. 6E

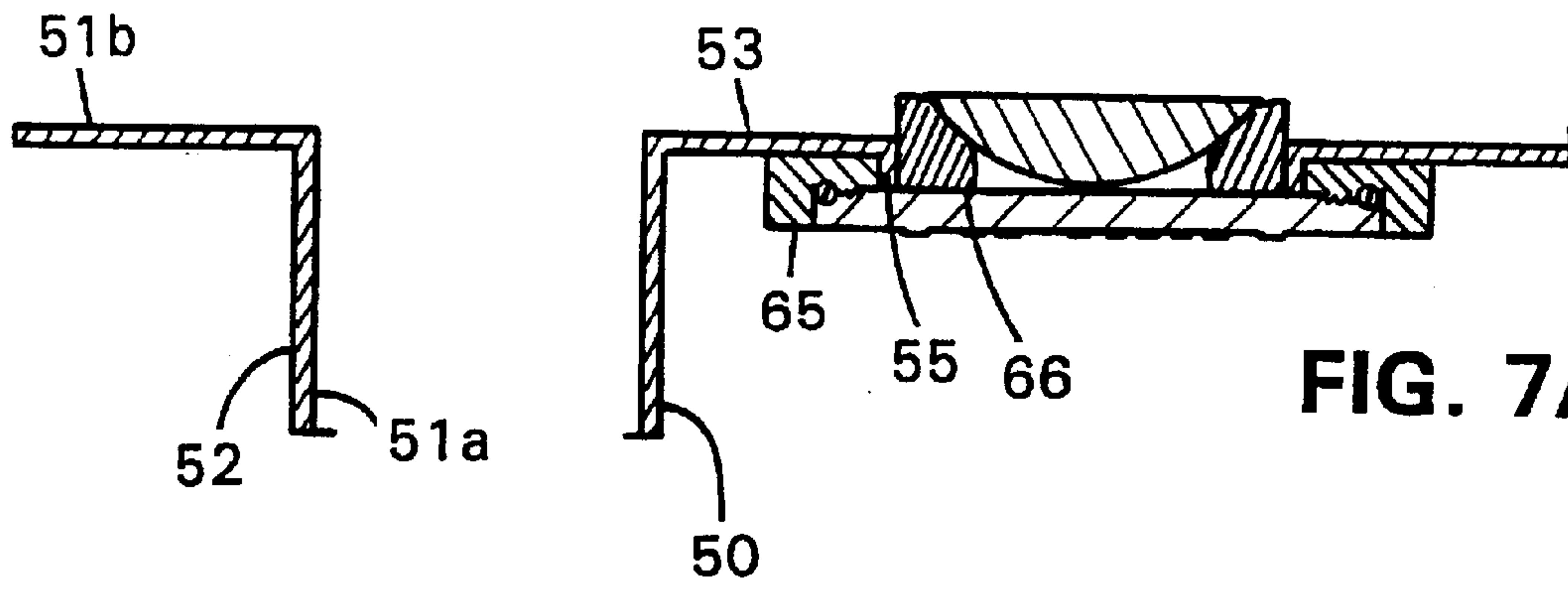
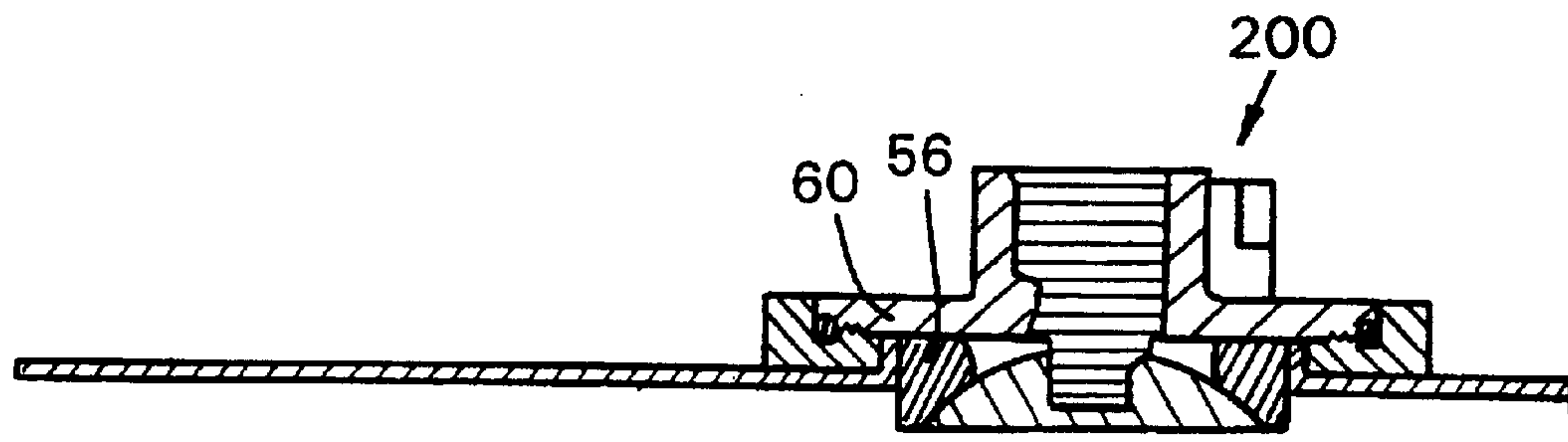


FIG. 7A

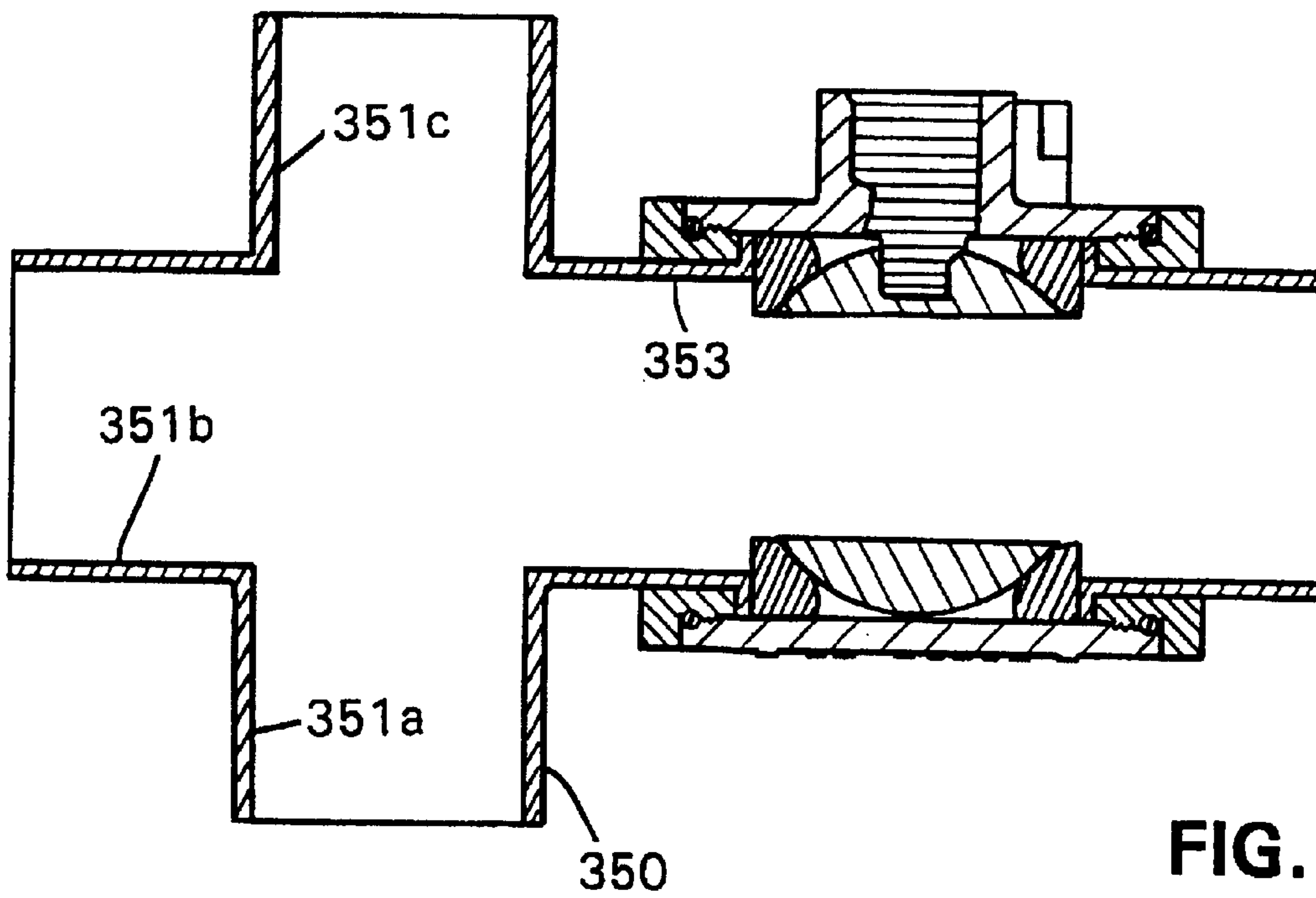


FIG. 7B

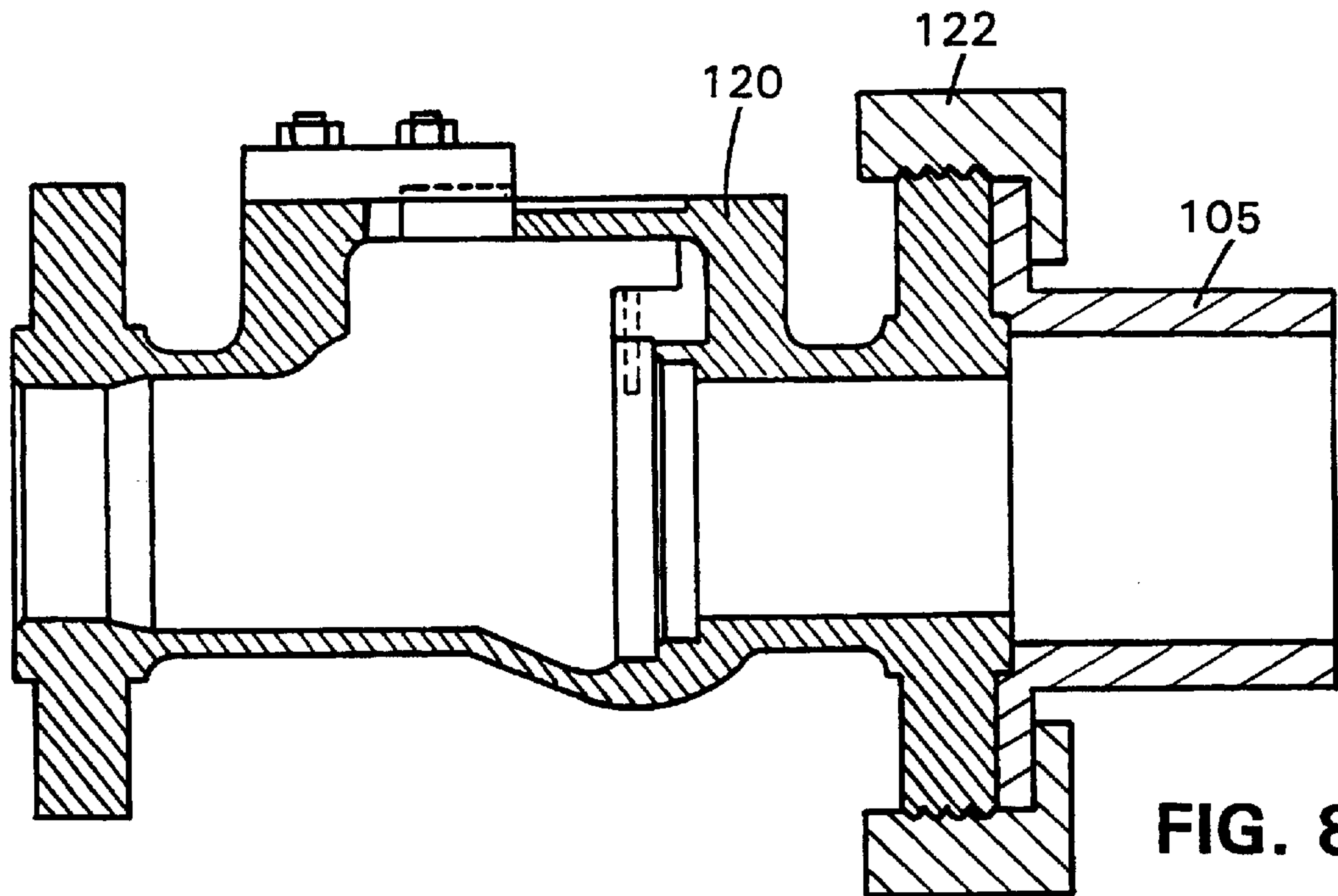


FIG. 8A

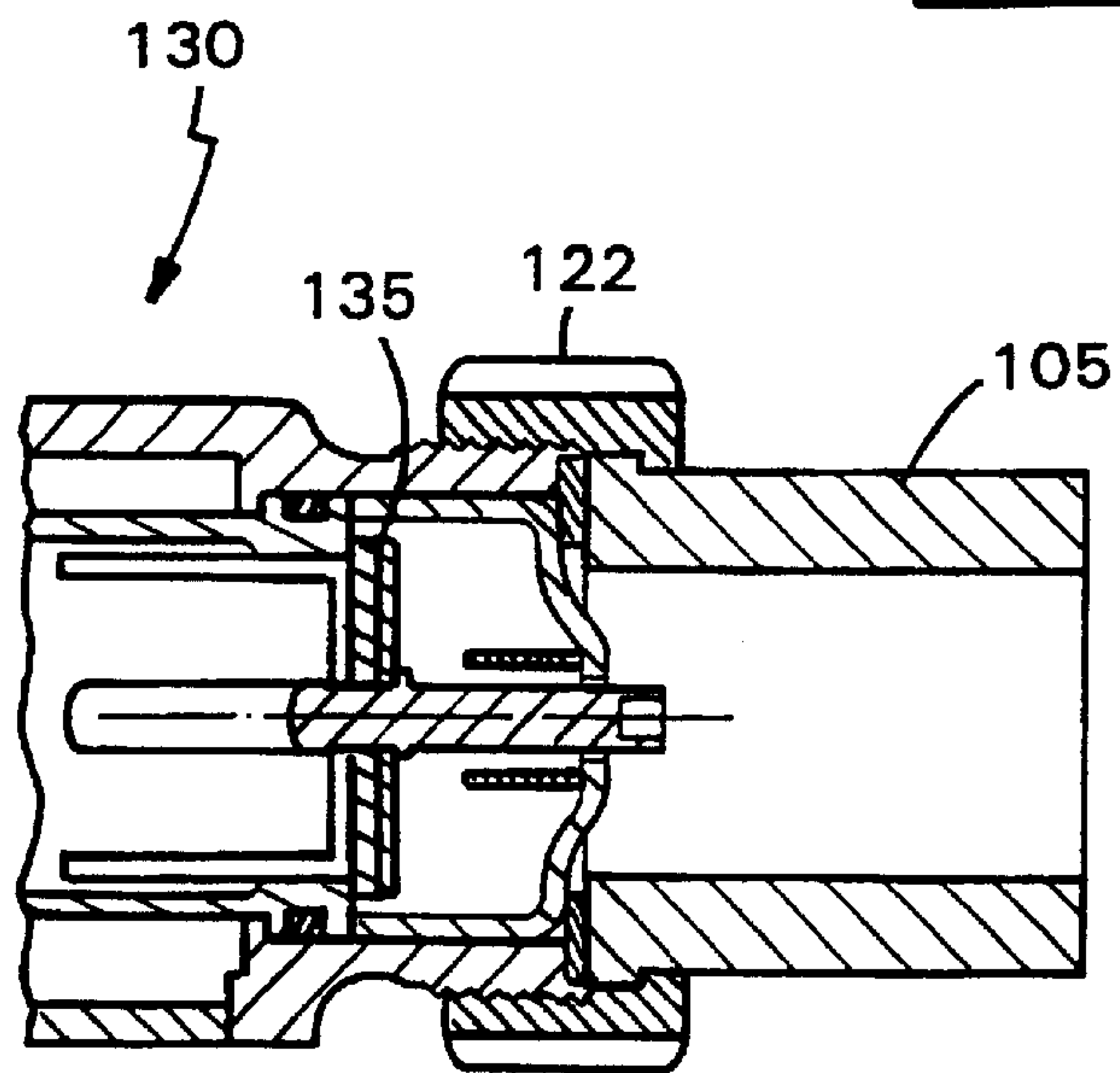


FIG. 8B

VALVE ASSEMBLIES

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. application Ser. No. 09/189,658, filed Nov. 10, 1998, entitled "Ball Valve Assemblies," now U.S. Pat. No. 6,019,349, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

The invention relates to valves for installation in piping.

Valve assemblies are often placed in fluid flow lines by "sweating" (i.e., soldering) the inlet and outlet of the valve assembly to opposed ends of piping. The elevated temperatures associated with sweating can, in some instances, cause thermal damage to plastic seals and other temperature-sensitive valve components within the valve assembly.

SUMMARY OF THE INVENTION

The invention provides a valve assembly that can be quickly and easily installed by sweating, with lower risk of thermal damage to thermally-sensitive valve components. The valve assembly of the invention includes removable tailpieces having thin walls of a relatively high thermal conductivity material, e.g., copper. The removable tailpieces can be disassembled from the valve body subassembly and sweated into place onto opposed pipe ends, with the valve body then reassembled to the tailpieces, typically after the tailpieces have cooled, thereby removing any possibility of thermal damage to the valve components.

In one aspect, the invention features a valve assembly including a valve body defining an inlet and an outlet, and a passageway for flow of fluid from the inlet toward the outlet; an attachment member in removable engagement with the valve body at one of the inlet and the outlet; and a pipe coupler releasably secured to the valve body by the attachment member. The pipe coupler is adapted for attachment to a pipe end by sweating.

Embodiments of this aspect can include one or more of the following features. The pipe coupler is formed of metal and have a wall thickness between about 0.040 to about 0.070 inch. The pipe coupler defines one inlet and one outlet, two inlets and one outlet, or three inlets and one outlet.

The attachment member engages an internal wall defining the passageway of the valve body. The internal wall defines threads and the attachment member includes a threaded union nut for threaded engagement with the internal wall. The pipe coupler also engages the internal wall. The attachment member engages an external wall of the valve body. The external wall defines threads and the attachment member includes a threaded union nut for threaded engagement with the external wall.

The valve body has first and second ends defining the inlet and outlet, respectively, and the pipe coupler abuts one of the first and second ends. The valve assembly is a ball valve, a check valve, or a gate valve.

The attachment member is in removable engagement with the valve body at the inlet, and a second attachment member is in removable engagement with the valve body at the outlet, a second pipe coupler is releasably secured to the valve body by the second attachment member, and the second pipe coupler is adapted for attachment to a second pipe end by sweating.

In another aspect, the invention features a valve assembly including a valve body defining an inlet and an outlet, and

an internal wall defining a passageway for flow of fluid from the inlet toward the outlet, the internal wall including threaded portions at the inlet and the outlet; a first attachment member in threaded engagement with the valve body at the inlet threaded portion; a second attachment member in threaded engagement with the valve body at the outlet threaded portion; a first pipe coupler releasably secured to the valve body at the inlet by the first attachment member, the first pipe coupler engaging the internal wall and being adapted for attachment to a pipe end by sweating; and a second pipe coupler releasably secured to the valve body at the outlet by the second attachment member, the second pipe coupler engaging the internal wall and being adapted for attachment to a pipe end by sweating.

In another aspect, the invention features a valve assembly including a valve body having a first end defining an inlet, a second end defining an outlet, and an external wall including threaded portions at the inlet and the outlet, the valve body further defining a passageway for flow of fluid from the inlet toward the outlet; a first attachment member in threaded engagement with the valve body at the inlet threaded portion; a second attachment member in threaded engagement with the valve body at the outlet threaded portion; a first pipe coupler releasably secured to the valve body at the inlet by the first attachment member, the first pipe coupler abutting the first end of the valve body and being adapted for attachment to a pipe end by sweating; and a second pipe coupler releasably secured to the valve body at the outlet by the second attachment member, the second pipe coupler abutting the second end of the valve body and being adapted for attachment to a pipe end by sweating.

In another aspect, the invention features a valve assembly including a valve body defining an inlet and an outlet, and a passageway for flow of fluid from the inlet toward the outlet; an attachment member in threaded engagement with the valve body at one of the inlet and the outlet; and a pipe coupler releasably secured to the valve body at the inlet by the attachment member, the pipe coupler being formed of metal and adapted for attachment to a pipe end.

Embodiments of this aspect of the invention can include one or more of the following features. The pipe coupler includes threads for attachment to the pipe end. The pipe coupler includes a flange for attachment to the pipe end. The valve assembly further includes a clamp for attaching the pipe coupler to the pipe end. The pipe coupler includes a circumferential ridge adapted to engage and interlock with a circumferential ridge of the pipe end.

In another aspect, the invention features a method for installing a valve assembly between opposed pipe ends by engaging a first pipe coupler upon a first pipe end; joining the first pipe coupler to the first pipe end in leak-tight relationship by sweating at a predetermined sweating temperature; engaging a second pipe coupler with a second pipe end; joining the second pipe coupler to the second pipe end in leak-tight relationship by sweating at a predetermined sweating temperature; thereafter, placing a valve subassembly between the first pipe coupler and the second pipe coupler, the valve subassembly including a valve body defining an inlet and an outlet and a passageway for flow of fluid from the inlet toward the outlet, a valve element disposed within the valve body for movement between a first position allowing flow of fluid from the inlet toward the outlet and a second position resisting flow of fluid from the inlet toward the outlet, and valve components susceptible to thermal damage at a damage temperature below the predetermined sweating temperature; engaging a first attachment member in leak-tight threaded engagement with the valve

body at the inlet in a manner to secure the first pipe coupler to the valve body; and engaging a second attachment member in leak-tight threaded engagement with the valve body at the outlet in a manner to secure the second pipe coupler to the valve body.

Embodiments of this aspect can include one or more of the following features. The pipe couplers are axially inserted into the passageway. The first and second pipe couplers second pipe couplers abut first and second ends, respectively, of the valve subassembly.

In another aspect, the invention features a ball valve assembly that includes (a) a valve body defining an inlet and an outlet, and a passageway for flow of fluid from the inlet to the outlet, (b) a ball valve subassembly including a ball valve element disposed within the passageway for rotational movement between a first position allowing flow of fluid from the inlet toward the outlet and a second position resisting flow of fluid from the inlet toward the outlet, and valve components susceptible to thermal damage at a predetermined temperature below sweating temperature, (c) a first attachment member in removable engagement with the valve body at the inlet and a second attachment member in removable engagement with the valve body at the outlet, (d) a first tailpiece releasably secured to the valve body at the inlet by the first attachment member, and (e) a second tailpiece releasably secured to the valve body at the outlet by the second attachment member, the first tailpiece and the second tailpiece adapted for attachment to opposed pipe ends by sweating.

In preferred embodiments, the first attachment member includes a first union nut removably attached upon the valve body in threaded engagement, and the second attachment member comprises a second union nut removably attached upon the valve body in threaded engagement.

In another aspect, the invention features a method for installing a ball valve assembly between opposed pipe ends. The method includes (a) engaging a first tailpiece upon a first pipe end, (b) joining the first tailpiece to the first pipe end in leak-tight relationship by sweating at a predetermined sweating temperature, (c) engaging a second tailpiece upon a second pipe end generally opposing the first pipe end, (d) joining the second tailpiece to the second pipe end in leak-tight relationship by sweating at a predetermined sweating temperature, (e) thereafter, placing a ball valve subassembly between the first tailpiece and the second tailpiece, the ball valve subassembly including a valve body defining an inlet and an outlet and a passageway for flow of fluid from the inlet to the outlet, a ball valve element disposed within the valve body for rotational movement between a first position allowing flow of fluid from the inlet toward the outlet and a second position resisting flow of fluid from the inlet toward the outlet, and valve components susceptible to thermal damage at a damage temperature below the predetermined sweating temperature, (f) engaging a first attachment member in leak-tight threaded engagement with the valve body at the inlet in a manner to secure the first tailpiece to the valve body, and (g) engaging a second attachment member in threaded engagement with the valve body at the outlet in a manner to secure the second tailpiece to the valve body.

Other features and advantages will be apparent from the following description and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side cross-sectional view of a valve assembly according to one aspect of the invention, with the tailpieces removably mounted to the valve body by union nuts.

FIGS. 2, 3 and 4 are sequential views, in which FIG. 2 is a side view a valve assembly of the invention with the tailpieces positioned on the opposed ends of piping; FIG. 3 is a similar view of the tailpieces of the valve assembly of the invention positioned on the opposed ends of piping for sweating, with the union nuts drawn back and the valve body removed; and FIG. 4 is a similar view of the valve assembly of the invention reassembled with the tailpieces sweated to the opposed ends of piping.

FIG. 5 is a side cross-sectional view of a ball valve assembly according to an alternate aspect of the invention.

FIGS. 6A–6E are side cross-sectional views of alternative tailpieces useful in securing piping ends to a valve assembly.

FIG. 7A is a side cross-sectional view of a valve assembly according to another aspect of the invention, with a T-shaped tailpiece removably mounted to the valve body by a union nut.

FIG. 7B is a side cross-sectional view of a valve assembly according to another aspect of the invention, with a cross-shaped tailpiece removably mounted to the valve body by a union nut.

FIGS. 8A and 8B are side cross-sectional views of alternative valve assemblies, each with a tailpiece removably mounted to the valve body by a union nut.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a valve assembly **10**, here a ball valve assembly being shown, includes a valve body **14** defining a passageway **15** for flow of fluid between an inlet **16** and an outlet **18**. The ball valve assembly includes a central ball valve subassembly **12** having a ball valve element **20**, which can be rotated (arrow, R) between an open position (shown) and a closed position using any suitable means (not shown), e.g. a manually-actuated handle or an electric, pneumatic or hydraulic actuator, all as well known in the art.

To permit valve assembly **10** to be easily sweat into place, without damage to heat-sensitive components, such as plastic seals **34**, valve assembly **10** includes a pair of removable pipe couplers, e.g., tailpieces **22**, **24**. Tailpieces **22**, **24** have thin walls, e.g., about 0.040 to about 0.070 inch thick, and are formed of a heat conductive material, e.g., metal, such as steel, copper, or bronze. Typically, tailpieces **22**, **24** are formed of high thermal conductive, solderable metal such as copper, to allow them to be quickly brought to sweating temperature. The valve body **14** is formed of metal, typically cast bronze.

Tailpieces **22**, **24** are releasably mounted to the valve body **14** by threaded union nuts **26**, **28** which engage with threads **30** defined at opposite ends of the valve body **14** in the regions of the inlet and outlet. A pair of seals **36**, **38**, e.g., o-rings, are mounted between union nuts **26**, **28** and valve body **14** to provide a fluid-tight seal. Union nuts **26**, **28** engage the shoulders **32** of the corresponding tailpieces **22**, **24**, which, in turn, bear upon the valve seals **34**, urging the valve seals into sealing engagement upon the opposite surfaces of valve element **20**.

Referring to FIGS. 2–4, a method of the invention for installing valve assembly **10** in a fluid flow line will now be described.

First, valve assembly **10** is partially disassembled by removing union nuts **26**, **28** and tailpieces **22**, **24**. Thus, referring to FIGS. 2 and 3, union nuts **26**, **28** are unthreaded from valve body **14** and valve body **14** and tailpieces **22**, **24** are removed. The union nuts **26**, **28** are then slid onto the

respective opposed ends **40, 42** of the piping to positions removed from the ends. The pipe ends **40, 42** are cleaned and engaged within the bores **23, 25** of the respective tailpieces **22, 24**, with a soldering flux material in the spaces between the opposed surfaces of the corresponding pipes and bores. The region of the joint is then locally heated to raise the temperature to the level required for sweating, and solder is applied to be drawn as a liquid into the space between the opposed surfaces of the corresponding pipe and bore. The solder then cools and hardens, securing pipe ends **40, 42** within tailpieces **22, 24**, and providing a leak-free seal.

Referring finally to FIG. 4, valve assembly **10** is then reassembled by replacing the valve body **14** between the tailpieces **22, 24** and threading union nuts **26, 28** onto valve body **14**, with shoulder **32** of each tailpiece engaged by the respective union nut. Tightening of union nuts **26, 28** urges the shoulders **32** of the corresponding tailpieces **22, 24** inwardly, which, in turn, bears upon valve seals **34**, to urge the valve seals into sealing engagement upon the surface of valve element **20**.

The installation method shown in FIGS. 2–4 and described above requires that there be axial play in the piping, to allow axial movement of the tailpiece faces, first outwardly to allow the valve body to be placed in position, and then inwardly, into the valve passageway, to bear upon the valve seal.

Another embodiment of the valve assembly of the invention is especially suited for use, e.g., in environments where there is no axial play in the piping. Referring to FIG. 5, valve assembly **100** is similar to valve assembly **10**, discussed above, and the components have been numbered accordingly. However, valve assembly **100** differs in that the union nuts and valve body are constructed so that the union nuts thread onto the outside, rather than the inside, of the valve body. Also, the valve body is sized to fit between the sweated-in-place tailpieces without axial movement of the opposed pipes. Threading union nuts **26', 28'** onto valve body **14** presses tailpieces **22, 24** upon the plastic seals **34**, resulting in shoulder-to-shoulder contact at region A. This contact results in sealing contact between the plastic seals **34** and the ball element **20**.

Tailpieces **22, 24** also can be secured to opposing pipe ends by methods other than soldering or welding. Referring to FIGS. 6A and 6B, tailpieces **46a, 46b** include threads **48a, 48b** on an outer surface **45** or inner surface **47**, respectively, of the tailpiece for engaging the piping ends. Referring to FIGS. 6C–6E, in other embodiments, a piping end **49** is secured to tailpiece **46d** with a clamp **51** (FIG. 6C); pipe **41** is secured to tailpiece **46d** by flanging ends **44d, 43d** of tailpiece **46d** and pipe **41**, respectively, and securing the tailpiece and pipe together, e.g., with bolts **42**, (FIG. 6D); or pipe end **44e** is secured to tailpiece **46e** by crimping to create a circumferential groove **40** (FIG. 6E).

Referring to FIG. 7A, a valve assembly **200** includes a tailpiece **50** in the shape of a “T” having two inlets **51a, 51b** and one outlet **53**. Tailpiece **50** is releasably mounted to a

valve body **60** by a threaded union nut **65**. Union nut **65** engages a shoulder **55** of tailpiece **50** forcing an outer surface **56** of the tailpiece shoulder to bear onto a valve seal **66**. Using “T”-shaped tailpiece **50** eliminates the need to install an external T-shaped pipe near the valve assembly. Alternatively, tailpiece **50** can be rotated **90** with shoulder **55** formed on central branch **52**. The tailpiece can also be formed in other shapes, such as y-shaped and cross-shaped-tailpiece **350** in FIG. 7B which has three inlets **351a, 351b, 351c** and one outlet **353**.

In other embodiments, the disclosed tailpieces can be used to connect piping to valves assemblies other than ball valves, such as, regulator valves, zone control valves, and backflow preventers. For example, referring to FIG. 8A, a tailpiece **105** is shown connected to a gate valve **120** by a union nut **122**, and, referring to FIG. 8B, a tailpiece **105** is shown connected to a backflow preventer **130** having a check valve **135** by a union nut **122**.

Other embodiments are within the following claims.

What is claimed is:

1. A method for installing a valve assembly between opposed pipe ends, the method comprising the steps of:

engaging a first pipe coupler upon a first pipe end,
joining the first pipe coupler to the first pipe end in leak-tight relationship by sweating at a predetermined sweating temperature,

engaging a second pipe coupler with a second pipe end,
joining the second pipe coupler to the second pipe end in leak-tight relationship by sweating at a predetermined sweating temperature,

thereafter, placing a valve subassembly between the first pipe coupler and the second pipe coupler, the valve subassembly including a valve body defining an inlet and an outlet and a passageway for flow of fluid from the inlet toward the outlet, a valve element disposed within the valve body for movement between a first position allowing flow of fluid from the inlet toward the outlet and a second position resisting flow of fluid from the inlet toward the outlet, and valve components susceptible to thermal damage at a damage temperature below the predetermined sweating temperature,

engaging a first attachment member in leak-tight threaded engagement with the valve body at the inlet in a manner to secure the first pipe coupler to the valve body, and

engaging a second attachment member in leak-tight threaded engagement with the valve body at the outlet in a manner to secure the second pipe coupler to the valve body.

2. The method of claim 1 wherein the pipe couplers are axially inserted into the passageway.

3. The method of claim 1 wherein the first and second pipe couplers abut first and second ends, respectively, of the valve subassembly.

* * * * *